PRE-PROJECT PROPOSAL

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INTRODUCTION

The Delta Robot is a specialized CNC architecture designed for high speed manipulation of small objects over a large work area. It has advantages over traditional “cartesian” CNC systems in that the independent joint positioning prevents compounding errors and improves accuracy. One such device has been outlined above.

Here the structure consists of 3 arms linked to a single point, and a central support brace to stabilize the assembly. The arms are controlled by motors at the top of the robot, adjusting the angle of each joint in order to position the head. A video of the Delta Robot in motion has been included in the encapsulating email to better outline its unique form of movement.

Clearly, the nature of this control architecture presents several challenges over systems operating on X-Y-Z coordinates. Due to the complex kinematics involved in tracing a designated path, many developers have opted for “direct-drive” CNC platforms, where the Delta Robot’s speed and flexibility might otherwise prove beneficial. As such, its adoption in the consumer market has been severely limited, despite clear mechanical advantages in applications like 3D printing.

OBJECTIVES

It is the goal then of this capstone project to produce a complete control system for the Delta Robot that is capable of attaining the accuracies required to print detailed objects, while maintaining a simple, robust, and versatile interface. Admittedly, these requirements lack a certain “technical challenge”, and as such students would take things a step further in finding new implementations for the device.

These implementations may take a variety of forms, but already interest has been found for its use as an automated bartender, or SHOTBoT. Several concepts in this area have cropped up in the past decade; most notably “Bartendro the Cocktail Dispensing Robot” which raised $200,000 in its funding campaign earlier this year. Bartendro consisted of an intelligent vacuum pump which, when connected to your smartphone, could dispense a set amount of alcohol into a stationary vessel. Several of these devices can be combined in order create mixed drinks at the push of a button.

The base Bartendro unit sells for $500, and provides users with 3 pumps. This can be configured all the way up to 15 the pump option, which retails for a whopping $2,400. The funding campaign saw almost 100 investors at tiers $1000 and above, and raked in several thousand from t-shirt and shot glass sales alone. Clearly, this is an idea for which the general public has a great appetite.

This capstone project seeks to build on the success of Party Robotics Inc. in creating a true robotic bartender through utilization of the Delta Robot. The “SHOTBoT” will be capable of serving a variety of beverages to multiple persons in rapid succession. It will seek to replace the functionality of standard waitstaff in ease of use, entertainment, and reliability. The creation process will be such that both hobby and industry will benefit from its development.

DELIVERABLES

There are several concrete products which will result from this system, first and foremost being a new and open source Delta Robot platform. While solutions to this problem exist already in industry, this capstone project will deliver an inexpensive and easy to implement method for kinematic control to the hobbyist spectrum that can be applied to 3D printing. Further development in liquid dispensing will also drive down the price point for Bartendro functionality, and enable average citizens to control their alcohol at price points below the $100 level. Finally, should the project progress according to plan, a fully capable bartending robot as outlined above will manifest itself by spring. This robot will carry forward much of the Bartendro’s success, in a highly marketable product.

RATIONALE

Clearly, this capstone project presents greater hurdles than dispensing liquids through a CNC system. While any amount of manpower might be able to solve these technical challenges in a "functional manner," in order for this endeavor to be deemed a success it must be highly robust, and fit for a consumer market. A product that is not just functional but useful requires a team of individuals dedicated to "better than good enough." For this reason, the following team has been outlined for the 2013-2014 capstone season.

Josh Dewitt

This member already possesses many of the network and computer programming skills required to manufacture this device. He has a strong background in developing & managing remote hardware, and a good understanding of internet protocol that will enable him to focus development on improved functionality over "getting things to work." He is proficient in collaboration on software projects, which alone is invaluable.

James Gehringer

Jamie has a great deal of experience with bio-medical engineering, and brings a thorough knowledge of the human-machine interface to the project. He works with many of the 3D mapping technologies that will be required in order to build this device. His skills in this area will enable the team to push the operability of the product past simple control systems to actual robotic intelligence, and define the system as whole.

Chad Staley

Chad has several years worth of experience in electronic assembly and PCB design. Much of his internship has consisted of the testing and verification of electronic systems, and is well practiced in the creation of complex signal networks. These skills will serve to produce a clean and robust hardware platform that can be well maintained and troubleshot with ease.

Evan Milton

With years of CNC experience, Evan has already designed and prototyped many of the components necessary to operate the Delta Robot. His mechanical engineering skills will allow for the construction of the precision components required by this system. He has a solid background in microcontroller implementation, and a firm understanding of the design process in delivering operational results under pressure.

Furthermore, all of the members listed above possess an excellent inter group dynamic, and rapport for high standards in engineering. Each has accumulated within the group through a mutual excitement for the product, and desire to push new boundaries in the fields of Electronics and Computer Engineering.

SUMMARY

The product outlined above represents a unique challenge, with the potential to fill a valuable niche in modern society. While the logistics may appear simple on paper, the implementation will prove extraordinarily difficult in exceeding the threshold for functionality. Students involved with this project will need to develop a concrete system of mathematically intensive motion control, web interface, and artificial intelligence requiring more than their individual skill sets would be otherwise capable of.